RLOP HNC E-1411 Flange Leak and Delayed Plant Start-up

IMPACT ERM Loss #36512
Investigation #22506

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Incident Date: April 26, 2012
Presentation Date: Aug 6, 2012

Incident Summary

E-1411 Inter-Reactor Quench Exchanger

- On April 26, 2012, HNC Start-up was delayed when E-1411 HX leaked during start-up (no flow in shell)
  - Shell-side flow re-established and leak stopped
- E-1411 again leaked during second start-up attempt (no flow in shell)
  - Shell-side flow re-established and leak stopped
  - Maintenance "checked tightness" of flange bolts
- During pre start-up hot strip (no flow in shell) leak again appeared. Hot strip completed with steam lances on leaks
  - At DED request all nuts replaced and newly engineered closure loads established.
- HNC Plant was started up leak-free. On-test April 30, 2012

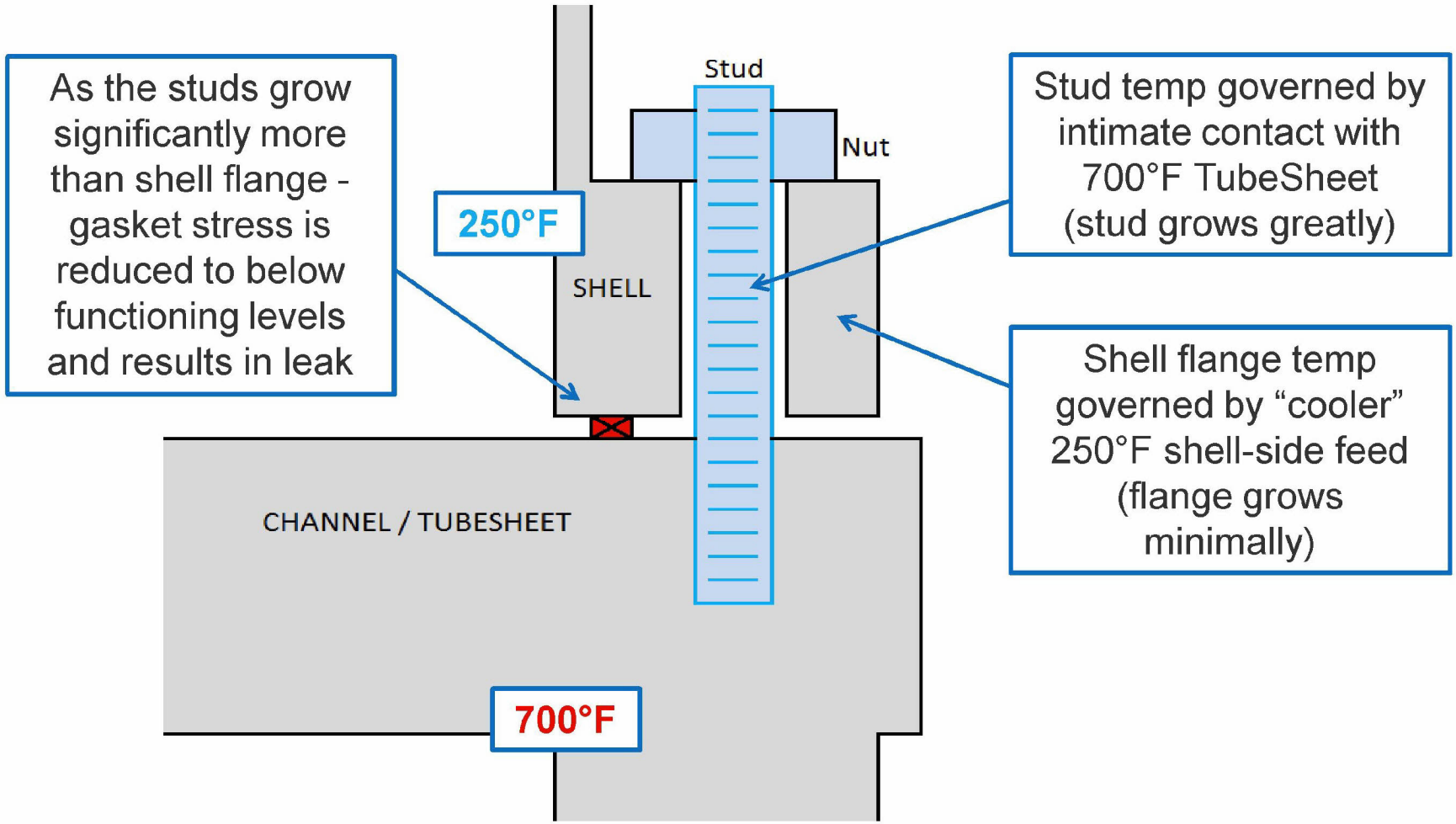
Root Cause 1

- What happened
  - No-flow conditions on E-1411 shell-side created large temperature differentials between cold shell and hot tube-side. These differentials create closure component differential growths that can significantly unload the gasket
- Why it happened
  - Operations desired to lower feed temperatures to allow for hot strip and subsequent Plant start-up.
- Proposed Solution
  - Recognize that unusual plant postures can create previously unexpected design conditions for E-1411 bolted closure, and design for such.

Root Cause 2

- What happened
  - When originally developed, the E-1411 closure procedure did not consider the extreme temperature differentials which occurred between shell and channel.
- Why it happened
  - ”No flow on shell-side” operating scenario was not anticipated as a likely event.
- Proposed Solution
  - Re-evaluate E-1411 closure procedure while considering the extreme temperature differentials that can occur in unusual operating situations.

E-1411 Flange Details



Casual Factor

- Initial loss of HNC recycle flow owing to K-1400 trip resulted in implementation of emergency shutdown procedures which caused a large temperature drop on the E-1411 shell-side relative to the hot tube-side inlet temperature.

  (Refer to Loss # 36434 and TapRoot Investigation # 22505)

Additional Considerations

- DED to develop E-1411 closure procedure which considers the extreme temperature differentials which can occur with shell-side no-flow conditions.
  - Preliminary study has determined that solution is feasible

Investigation + / Δ

- What Went Well:
  - Excellent and varied team representation
  - Event details were very clearly known
  - Investigation was performed in a timely manner while accurate operational information could be readily obtained
- What Can We Improve Next Time:
  - If this investigation would have been done in 2008 when HX first leaked, it may not be required at this time

Questions